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EFFECT OF MANAGEMENT SYSTEM ON NUTRIENT INTAKE AND SEMINAL ATTRIBUTES IN JAMUNAPARI BUCKS

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KEYWORDS

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Management systems

Semen quality

ABSTRACT

The present study assessed comparative semen production potential of Jamunapari bucks under stall feeding (SF) and grazing cum supplementation (GS) systems of 10 animals in each system under group feeding and management conditions. SF Bucks received 500 g concentrate pellets and 700 g green fodder/h/d besides *ad lib* dry fodder for continuous one year. GS Bucks were allowed 4-6 hr daily grazing and supplemented concentrate pellets @ 500 g/h/d. Intake of nutrients by bucks in two groups were calculated, semen were collected using AV method biweekly to assess seminal traits. The apparent digestibility coefficients of dry matter, crude protein and hemi cellulose were higher in feed materials consumed by GS bucks than SF bucks. However, neutral detergent fibre, acid detergent fibre and cellulose digestibility had shown a reverse trend. The overall Least Square Mean (LSM) for intake of DM, OM, CP, NDF, ADF, hemicellulose, cellulose, ME install-fed bucks were 1309.38, 1190.62, 176.99, 728.72, 410.08, 306.11, 266.09 g/day, 7.76 MJ/d, respectively. The respective nutrients intake in GS bucks were 1396.14, 1259.67, 198.87, 685.24, 367.99, 335.99, 211.23 g/day, 8.21MJ/d. LSM for volume (ml), color (1-2 scale), consistency (1-4 scale), mass activity (0-5 scale), initial progressive motility (%), sperm density(10^6 /ml), live sperms (%) and abnormal sperms (%) of semen produced by SF bucks were 0.92, 1.19, 2.86, 4.30, 78.21, 4317.41, 82.96, and 1.77, respectively. The respective values for the semen of GS bucks were 0.69, 1.24, 2.67, 3.64, 72.78, 3183.14, 74.87 and 2.18. Analysis of data revealed that SF bucks performed better ($P<0.01$) with lower nutrients intake than the GS bucks.

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1 Introduction

Goats are reared under extensive, semi-intensive and intensive systems of management. They are widely adapted and reproduce efficiently in different climatic conditions. The production performance varies and widely depending upon inputs available under different production systems. Reproduction is a complex physiological process involving entire animal body to achieve its function of production of young ones. Several studies have documented interrelationship between nutrient intake and reproductive performance in adult males (Singh & Sengar, 1990; Walkden-Brown et al., 1994; Dana et al., 2000; Fernandez et al., 2004; Mohamed & Abdelatif, 2010). Studies on the effect of nutrition on quantity and quality of semen produced by goat bucks were limited (Mekasha et al., 2007; Mellado et al., 2012). Although literature pertaining to semen production potential of breeding bucks under particular system of management is widely available, studies on the performance under different management system are scanty (Hanmante et al., 2009). Therefore, the present study was aimed to determine effect of two management systems on nutrient intake and seminal traits in adult Jamunapari bucks.

2 Materials and Methods

The present study was conducted at ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura. The mean monthly weather parameters that were recorded during experiment were maximum (22.44 - 41.21°C) and minimum (4.18 - 26.16°C) temperature, relative humidity (30.43 - 74.59 %), vapor pressure (8.15 - 25.43 mmHg) and cumulative rainfall (0 - 132.4 mm) as well as duration of sun shine (168.70 - 306.99 hrs).

2.1 Experimental animals and their management

Twenty Jamunapari bucks of almost similar age (659.25±2.79 days) and body weight (29.55±0.67 kg) stationed at institute's experimental farm were randomly selected. Ten animals were allotted each to stall feeding (SF) and grazing cum supplementation (GS) systems under group feeding and management conditions. Bucks were managed and fed in two separate groups uniformly. Bucks under SF system were offered 500 g/h/d pelleted concentrate mixture and 700 g/h/d green fodder besides available dry fodder *ad libitum*. Concentrate pellets comprised of Barley (10%), Deoiled rice polish (20%), Til/groundnut cake (expeller) (40%), wheat bran (20%), molasses (7%), mineral mixture (2%) and salt (1%). Green fodders viz. berseem, cowpea, oats, barley, and dry fodders viz. gram, arhar, wheat, or barley straws were used for feeding the SF bucks. Bucks under GS group were allowed for 4 to 6 hours daily grazing in the institute grazing area and supplemented with concentrate pellets @ 500 g/h/d. The grazing material available to animals of GS group varied according to seasons. Clean drinking water was made available round the clock in open paddocks for both groups.

The feed and forage samples were collected from grazing area and feeding troughs. Faecal samples were collected from twelve (6 each) randomly selected bucks using faecal bags for half an hour in the morning and evening. All these samples were collected for five consecutive days on 6th to 10th day of chromium oxide feeding in mid of each season, dried in an oven at 60 to 70°C for 24 hours, stored in plastic bags and proximate composition was carried out subsequently. The AOAC (1999) analytical procedures were used for organic matter (OM) determination by ash at 550°C for 4 hour; nitrogen (N) estimation by Kjeldahl technique; total lipids were estimated using solvent extraction procedure by soxhlet apparatus. Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) were determined by sequential procedure using same sample (Robertson & Van Soest, 1981; Van Soest et al., 1991).

2.2 Estimation of nutrient intake

The forage intake of GS bucks from grazing area was estimated using lignin ratio technique (Shinde et al., 2000; Singh et al., 2004). The total dry matter intake of bucks from both groups was calculated through total quantity of feed consumed daily on dry matter basis. The intake of different nutrients was calculated by deducting out go of nutrients in faeces from total daily intake of that particular nutrient after proximate analysis of feeds, forages and faecal samples. The total faecal output of experimental bucks was estimated using Chromium Oxide Paper Capsule Indicator Method (Shinde et al., 2000). The metabolizable energy (ME) intake was calculated as per ARC standard

$$MEI = OMI, g \times 19 \times 0.82.$$

2.3 Semen collection and Evaluation

The semen from all breeding bucks of both groups was collected using Artificial Vagina (AV) method twice a week after giving one false mount and a single collection was taken from each buck. Quantitative seminal traits viz. volume, sperm density per ml and qualitative traits viz. colour, consistency, mass activity, progressive motility, live sperms count and total abnormal sperms count were estimated as per semen analysis procedure.

2.4 Statistical analysis

The data generated on nutrient intake, semen quantity and quality were analyzed using least squares means and analysis of variance (Harvey, 1990). Arc sine transformation was carried out for per cent values viz. sperm motility, live sperms count etc and logarithmic transformation was done for sperm concentration before analysis of the data for finding significance between groups.

3 Results and Discussion

3.1 Impact on Nutrients

The average dry matter (DM), organic matter (OM), crude protein (CP), Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), hemicellulose and cellulose digestibility of feed and forages consumed by SF bucks were observed to be 58.18%, 61.37%, 60.46%, 51.60%, 36.32%, 69.35% and 45.43%, respectively. The respective digestibility of nutrients for GS bucks was 60.43%, 62.84%, 63.07%, 48.69%, 26.88%, 74.94% and 41.45% (Table 1). Perusal of table indicated that digestibility of nutrients consumed by the GS bucks was significantly higher than SF bucks except for organic matter.

The intake of DM, OM, CP and metabolizable energy (ME) in Jamunapari bucks under GS system (1396.14, 1259.67, 198.87 g/d and 8.21 MJ/d) were significantly higher than bucks under SF system (1309.38, 1190.62, 176.99 g/d and 7.76 MJ/d). However, intake of fibre fractions of diet viz., NDF, ADF, cellulose was significantly higher in bucks under stall feeding than GS system. The information on nutrient intakes of breeding males is meager. The digestibility coefficients of nutrients consumed by Jamunapari bucks in the present study corroborate with findings of Raghuvansi et al. (2007) in adult rams under different management systems. Significantly higher DM, CP and ME intakes of GS bucks as compared to the bucks under SF system could be due to consumption of

wide range of grazing materials in addition to supplementation. However, Raghuvansi et al. (2007) reported significantly higher ($P<0.01$) DM, OM, CP and ME intake in stall fed lambs than semi-intensively reared lambs. The lower nutrient intake in kids (Dutta & Singh, 2009) and young bucks (Mekasha et al., 2007; Mekasha et al., 2008) under intensive rearing system and adult bucks (Tripathi et al., 2007) under extensive rearing system have also been reported. However, Raghuvansi et al. (2007), reported higher ME intake (8.92-12.35 MJ/d) in rams under intensive rearing system than the present study. Similarly, the digestible energy (GE) intake of the young Ogaden bucks of Ethiopia was reported as 5.1 to 8.5 MJ/kg DM under intensive rearing system (Mekasha et al., 2007). Differences in nutrient intake could be attributed to variation in availability and type of feed and its quality, grazing behavior, system of rearing and age of experimental animals etc.

3.2 Impact on seminal traits

The least squares means and analysis of variance for seminal traits were presented in Table 2. The volume, color, consistency, mass activity, initial progressive motility, sperm density, live sperms and abnormal sperms of semen of SF bucks were recorded to be 0.92 ml, 2.86 (1-4 scale), 4.30 (0-5 scale), 78.21 %, 4317.41 millions/ml, 82.96 % and 1.77 %, respectively which were significantly higher ($P<0.01$) than those reared under GS system (0.69, 2.67, 3.64, 72.78, 3183, 74.87 and 2.18).

Table 1 Least squares means and analysis of variance for nutrient digestibility and nutrient intake of Jamunapari bucks reared under different management systems

Attributes	System of management		Significance level
	Stall feeding	Grazing plus supplementation	
<i>Nutrient digestibility coefficients (%)</i>			
Dry matter	58.18 ± 0.54	60.43 ± 0.54	**
Organic matter	61.37±0.52	62.84±0.52	NS
Crude protein	60.46± 0.66	63.07± 0.66	**
Neutral detergent fibre	51.60±0.98	48.69± 0.98	*
Acid detergent fibre	36.32± 1.13	26.88± 1.13	**
Hemicellulose	69.35± 1.35	74.94± 1.35	**
Cellulose	45.43± 1.25	41.45± 1.25	*
<i>Nutrient Intake (g/day)</i>			
Dry matter	1309.38 ± 21.74	1396.14 ± 21.74	**
Organic matter	1190.62±19.66	1259.67± 19.66	*
Crude protein	176.99± 3.02	198.87± 3.02	**
Neutral detergent fibre	728.72± 11.63	685.24± 11.63	*
Acid detergent fibre	410.08 ± 6.39	367.99 ± 6.39	**
Hemicellulose	306.11± 5.49	335.99± 5.49	**
Cellulose	266.09 ± 3.91	211.23± 3.91	**
Metabolizable Energy (MJ/d)	7.76± 0.13	8.21± 0.13	*

** $P<0.01$ * $P<0.05$ NS- Non-Significant

Table 2 Least squares means and analysis of variance for seminal parameters of Jamunapari bucks reared under different management systems

Seminal parameters	System of management		Significance level
	Stall feeding	Grazing plus supplementation	
Volume (ml)	0.92 ± 0.02	0.69 ± 0.02	**
Color (1-2 scale)	1.19 ± 0.02	1.24 ± 0.02	NS
Consistency (1-4 scale)	2.86 ± 0.03	2.67 ± 0.04	**
Mass activity (0-5 scale),	4.30 ± 0.07	3.64 ± 0.07	**
Initial progressive motility (%)	78.21 ± 0.01	72.78 ± 0.01	**
Sperm concentration (10 ⁶ /ml)	4317.41 ± 1.03	3183.14 ± 1.03	**
Live sperms (%)	82.96 ± 0.01	74.87 ± 0.01	**
Abnormal sperms (%)	1.77 ± 0.001	2.18 ± 0.001	**

** P<0.01 NS- Non-Significant

The semen production potential of bucks varies with age, breed, season, nutrient intake, rearing systems, semen collection methods. No abnormality of color in any of 660 samples observed in current study indicated that semen collection procedure was proper. The significantly ($P<0.01$) higher semen quantity as well as quality of SF bucks as compared to GS bucks in the present study indicated the availability of more nutrients for production in SF bucks. However, Fourie et al. (2004) in young Dorper rams and Hanmante et al. (2009) in Osmanabadi bucks reported superior semen quality under extensive and semi-intensive rearing systems, respectively as compared to stall-fed system. The lower (Srinivas et al., 2002; Sundararaman & Edwin, 2003; Naing et al., 2011) and higher seminal parameters under intensive (Kulaksiz & Daskin, 2010; Salviano et al., 2012; Fonseca et al., 2013; Qureshi et al., 2013; Ahmad et al., 2014) and semi-intensive (Thakur et al., 2005; Hassan et al., 2010) rearing systems have also been reported. The variation in semen quality parameters under different rearing systems in the present study could be due to variation in nutrient availability for semen production, breed and age of bucks which corroborates earlier findings (Mekasha et al., 2007; Bucak & Uysal, 2008; Mohamed & Abdelatif, 2010; Naing et al., 2011; Mellado et al., 2012; Ramachandran et al., 2015).

The LSM for abnormal sperms of semen produced by GS bucks was significantly ($P<0.01$) higher than SF bucks (2.18 Vs 1.77%) which was lower than report of Naing et al. (2011) in Boer bucks. Dorado et al. (2010) also recorded higher mean abnormal sperms (18.52 to 35.40 %) in Florida bucks. Contrary to this research findings, Fourie et al. (2004) reported significantly higher overall abnormal sperms in young Dorper rams reared under intensive system than those under extensive system (12.1 vs 17.2%). The abnormal sperms recorded in the present study were much lower than previous reports under different management systems. This may be attributed to better feeding management of bucks. The higher overall sperm abnormality of GS bucks in the present study could be due to higher energy expenditure during grazing. This could lead to low nutrient availability towards supply of nutrients required for sperm production, although energy and protein intakes were significantly higher in GS bucks. Further, significantly

lower sperm abnormality (1 to 2%) observed in the present study *vis-à-vis* the results of all previous reports could mainly be due to the variation in data transformation apart from variation arising out of genetic and non-genetic factors like breed, age and semen collection, processing and evaluation procedures.

Conclusion

The present study indicated that the nutrients intake in terms of dry matter, crude protein and metabolizable energy was significantly higher in bucks under grazing plus supplementation system than that of bucks under stall feeding system. The seminal traits of stall fed bucks were superior to GS bucks, though; all the seminal traits studied were within the range required for fertility under both management systems round the year. Therefore, it could be inferred that stallfed bucks can perform better with lower level of nutrients intake than GS bucks under studied level of nutrients intake and feeding system.

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Conflict of interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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